Chapter iv. we have a systematic account of the action of fluorine on the non-metallic elements and on some of their compounds, together with a somewhat detailed study of the non-metallic fluorides. The action of fluorine on the metals and their compounds forms the subject-matter of Chapter v., the organic fluorine compounds receiving treatment in Chapter vi. The last chapter in the book deals with the atomic weight of fluorine, the volumetric composition of hydrofluoric acid, the action of fluorine and hydrofluoric acid on glass, and the position of fluorine in the system of the elements. The author definitely places fluorine at the head of the halogen family, sufficient stress, however, being laid on the points in which fluorine resembles the elements of the oxygen family; such as the ease with which it unites with carbon, and the analogies exhibited by hydrofluoric acid to some dibasic acids. A short summary of the properties of fluorine concludes the volume, and for frontispiece there is an excellent portrait of the author.

The book is as interesting as a monograph can well be, and M. Moissan has earned the gratitude of all chemists by thus placing before them a connected record of one branch of his splendid activity. J. W.

OUR BOOK SHELF.

A Text-Book of Physical Chemistry. By Dr. R. A. Lehfeldt. Pp. xii + 308. (London: Edward Arnold, 1899.)

A FEW years ago the teacher of physical chemistry seeking a suitable elementary text-book, dealing with the more recent developments of the subject, which he could put into the hands of a class of students approaching the study of physical chemistry for the first time, was somewhat embarrassed to find one. This state of things is now changed for the better by the recent appearance of several very excellent works; among these Dr. Lehfeldt's book will take a high place. The author explains in his preface that the book "is intended to contain what a student—with limited time and many subjects to learn—may usefully read. It is by no means written to suit any examination, but still is written with the practical requirements of students in view."

Dr. Lehfeldt has succeeded in avoiding the unessential and in explaining the fundamental ideas of modern physical chemistry in a thoroughly lucid manner, so that a student who has grasped the contents of this book will experience little difficulty in appreciating the meaning of the larger handbooks or original memoirs.

An introductory chapter on physical units will be useful to chemical students, who are, perhaps, apt to be slipshod in such matters. This is followed by a chapter on molecular weights in gases and solutions, which includes electrolytes and the ionic theory, and by a very well-considered chapter on the connection between physical properties and chemical constitution. The principles of thermodynamics are then explained; and the two laws (*a*) of chemical equilibrium in a system of perfect gases at constant temperature, and (*b*) of the influence of temperature on chemical equilibrium are deduced from them. This chapter presupposes some knowledge of the elements of the calculus, but any student who wishes to understand physical chemistry must make up his mind to acquire the small amount of mathematical knowledge requisite.

The applications of the two thermodynamic theorems to chemical change and equilibrium in homogeneous and heterogeneous systems are then taken up. This treatment has the great advantage that the whole of the phenomena can be grouped in a very simple way, the close relationship of chemical and physical change is clearly brought out, and the student is not bewildered by the apparent multiplicity of the phenomena. The book concludes with a brief but most interesting chapter on the theory of the galvanic cell, and the connection between electromotive force and chemical affinity. The book may be unhesitatingly recommended as one of the best of its kind.

The only misprint we have noticed occurs on p. 141, line 18, where "increases" is written in place of "decreases." T. E.

An Introduction to Analytical Chemistry. By G. G. Henderson, D.Sc., M.A., and M. A. Parker, B.Sc. Pp. 228. (London: Blackie and Son, Ltd., 1899.)

THIS is a compact work covering the ground of ordinary qualitative analysis as well as the tests for a number of organic substances, and also containing an account of the most important processes of quantitative analysis.

Without being designed on any new plan or being explanatory to the fullest extent, the book is written in a scientific spirit. The authors state that they have made free use of the works of Dittmar and others, and it is perhaps not uncomplimentary to remark that the influence of that sterling chemist is apparent in the book.

The directions for work are clear and practical, and the analytical methods quite satisfactory. Perhaps the least useful part of the book is that dealing with organic substances and their separation from mixtures. This branch of analytical art is very difficult, and the particular form of it, which has been encouraged by certain examining bodies, has brought disaster to many a good student. It is difficult to understand what useful purpose is served by the efforts of second-year students to prepare for recognising the constituents of, say, a mixture of urea and an inorganic salt. It is of no importance to medical men, it does not help the teaching of organic chemistry, and it crowds out practical work which would be of real value. The examination of such mixtures is a matter for an analyst of mature knowledge and experience. A. S.

Maryland Weather Service. Vol. i. Pp. 566. (Baltimore: The Johns Hopkins Press, 1899.)

THE Maryland State Weather Service was established in 1892, and its reports and climatic charts are favourably known to meteorologists. In 1896 a plan of closer co-operation between the National and State Weather Bureaux was proposed by Prof. W. L. Moore and adopted. This marked the commencement of a new and very important period in the history of the Service, and the present volume is the first published since the two organisations have been in close connection. The energies of the Service are now to be devoted chiefly to the publication of special reports on the climatology of the State, and if the volume before us is to be taken as an earnest of future ones, we may be pardoned a feeling of envy at the sumptuous way in which scientific work of this kind is presented to the public in America. We notice that it is proposed to publish in the near future a full account of the climatic features of Maryland, in which the physiography, meteorology, hydrography, medical climatology, agricultural soils, forestry, crop conditions and the fauna and flora of the State will be considered.

The present volume is confined to the physiography and meteorology, and includes an introduction by Prof.

Bullock Clark, on the establishment and organisation of the Maryland Weather Service; a description of the physiography of Maryland, by Dr. Cleveland Abbe, jun.; a report on the meteorology of Maryland, by Dr. Abbe, Mr. F. J. Walz and Dr. O. L. Fassig; and a contribution on the aims and methods of meteorology, by Prof. Cleveland Abbe, already noticed in these columns (vol. lxi. p. 448). The illustrations are numerous, instructive, and of a very high class, most of them being full-page collotype plates or lithographs. No State or country has given to the scientific world a volume in which the operations of the "Weather Service" are interpreted more liberally, or the work presented in a more elaborate *format.*

Volta e la Pila. By Prof. Augusto Righi. Pp. 40. (Milan: Tip. Bernardoni di C. Rebeschini, 1900.)

THIS is an inaugural discourse delivered by Prof. Righi on September 18, 1899, at the National Electrical Congress at Como. It deals with (1) the science of electricity prior to Volta; (2) the scientific work of Volta considered apart from his discovery of the pile; (3) Galvani's discovery of electricity of contact; (4) the pile; (5) the theory of the pile; and (6) conclusions. In an appendix, Prof. Righi gives a note on the theories of the pile, in which he expresses favourable opinions on the "osmotic" theory.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

An Optical Phenomenon.

IN connection with Prof. Simon Newcomb's letter on "Terrestrial Gegenschein" (NATURE, October 5, 1899) and the subsequent letters of Mr. Mallock (NATURE, October 12 and November 9, 1899), I desire to call attention to an analogous and very beautiful phenomenon of perspective which I should have mentioned at the time but that the winter season of the year is not favourable to its observation in this country.

When the sun is high and shining brightly in a clear sky, let an observer stand so that the shadow of his head falls on the surface of water that is deep, clear, but not quite clear, and slightly agitated by the wind. He will observe that from the place where the shadow of his head falls shafts of light seem to radiate in all directions. When once well observed, the phenomenon is very striking, but it has surprised me to find how few persons have noticed it. I first observed it many years ago, when I used daily, about mid-day in summer, to cross the bridge over the channel leading to the boat store in the Portsmouth Dockyard, near the main entrance. But it was not till a year later, on Ulleswater, that I found the explanation. The lake was there turbid in parts from the washings of mines, but quite clear in others. Standing up in a boat, one could see the phenomenon very clearly where there was very slight turbidity, but not if the water was quite clear, nor if there was much turbidity, and never in a dead calm. This gave the explanation. The convexities of the surface, when there is a slight agitation, acting as lenses, split up the otherwise uniform illumination into separate, parallel shafts of light, each consisting of slightly convergent rays, which, traversing the liquid, are rendered visible by the suspended particles that they illuminate. These shafts seen in perspective have their point of apparent convergence exactly opposite to the sun, *i.e.* in the shadow of his head. If the water is smooth, there are no particles to illuminate and reveal the shafts; if too turbid (or too shallow), the light does not penetrate far enough. If the sun be too low in the sky, too little light enters the water; if it shines through clouds, so that the source is diffuse, a uniform illumination results. Hence the rays are not easily noticed in winter.

After the phenomenon has once been well seen under such circumstances as I have described, one can hardly enter a boat on a bright day without being haunted by it, and realising that, although the shadow of one's head may not actually fall on the water, yet every streak of light in the water radiates from it.

A. M. WORTHINGTON.

R.N Engineering College, Devonport, July 22.

Temperatures of Recently Killed Chamois.

MR. E. N. BUXTON, in his fascinating "Short Stalks" remarks (p. 38, footnote): "A friend of mine once took the temperature of a freshly killed chamois, and it stood at 130° F." There is no doubt that many professional chamois hunters believe that the temperature of the animal is considerably higher than that of domestic animals.

During the last three years I have determined the rectal temperature of twenty-nine recently killed chamois.

These may be divided into three classes.

A.—*Those successfully stalked and dropped dead by the first shot.* (12 observations.)

With two exceptions, the temperatures, taken in every case within five minutes of death, lie between 101°·1 and 101°·9, the average being about 101°·5 F., or 38° 6 C.

The two exceptions were (i.) a kid four or five months old, the temperature of which was 103°·2 F., or 39°·6 C., and (ii.) a doe which had received a severe flesh-wound in the back eight days previously, the temperature of which was 102°·4 F., or 39°·1 C.

B.—*Those shot au galop.* (7 observations.) These animals all dropped dead in their tracks, or died almost immediately.

The temperatures on the whole were found to be distinctly higher than in class A, being 101°·5, 102°·3, 102°·4, 102°·9, 102°·9, 103°·5 and 104°·5 respectively.

The first four of these had run from 40 to 50 yards, the fifth about 200 yards, and the last two about 100 yards. The last two were young bucks, which, to judge from the appearance of their incisor teeth, were four and three years old respectively.

C.—*Those wounded at the first shot, but only brought to bag after some interval.* (10 observations.)

Here the temperatures are, on the whole, still higher.

The lowest (101°·7) was that of an animal which ran 50 yards after the first shot, and was then dropped dead by a second.

The next (102°·4) ran about 300 yards. The third (102°·9) was wounded in the stomach, then walked about 250 yards towards me, and was dropped by a second shot at about 30 yards.

The fourth (103°·1) ran about 200 yards. The fifth and sixth (103°·3 and 103°·5) were shot through the kidneys, but were not killed outright by the shot.

The remaining four showed temperatures of 104°·9, 105°·6, 106°·2 and 106°·7.

Of these the first had its fore-leg broken, and was recovered twelve hours later.

The second and fourth were recovered about half an hour after being wounded.

The third was an animal whose hind-leg was broken. It then escaped into another valley, and hid itself in a cave on a rock-wall, where it was spied about four hours later. A second shot failed to hit it, but drove it out of the cave. It then tried to climb the steep rocks above it, and after twice failing to overcome a *mauvais pas*, slipped and fell about 100 feet, and was killed by the fall.

Results similar to these were obtained in 1898 by a Swiss friend of mine. Some of the animals were driven by dogs, and these always showed a higher temperature than those stalked and killed by the first shot, the temperatures of the driven animals varying from 103°·6 to 105°·8.

The highest temperature obtained by him was 107°·6 (42° C.). This was an animal which was severely wounded in the back, then lost till twenty-four hours later, when it was found and killed by a dog.

How far the average temperature given under A represents the normal temperature of the living chamois, I am unable to say, because I do not know to what extent sudden death by a bullet would be likely to affect the reading of the thermometer. Perhaps some physiologist would kindly throw some light upon this point.

To save the trouble of calculation to any foreign reader who may see this letter, I may add that 38° C. = 100°·4 F., 39° C. = 102°·2 F., 40° C. = 104° F., 41° C. = 105°·8 F., 42° C. = 107°·6 F.

G. STALLARD.

Rugby, July 12.